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AUTHORITY

NSWC notice dtd 9 Feb 1976; NSWC notice dtd 9 Feb 1976

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U. S NAVAL PROVING GROUND DAHLGREN, VIRGINIA

REPORT NO 1073

BOMBS AND ASSOCIATED COMPONENTS

50th Partial Report

BALLISTIC TEST OF 1000# LOW DRAG, G P. BOMB
TYPE EX 10 MOD 12

FINAL Report

Task
Assignment NPG-Re3c-321-1-52
Classification CONFIDENTIAL
SECURITY INFORMATION

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FEB - 3 1953

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PART A

SYNOPSIS

1. The tests reported herein were conducted to determine: (1) the maximum STS armor plate thickness which the 1000 lb. Low Drag G.P. Domb Type EX 10 Mod 12 will penetrate at 1000 ft./sec. velocity and remain in effective bursting condition; (2) the maximum thickness of reinforced structural concrete the bomb will penetrate at 1000 ft./sec. velocity and remain in effective bursting condition; (3) in accordance with reference (c) to compare bombs finished by heat treating with those finished by normalizing; (4) any points of weakness or cause of failure in the design, and (5) chemical and metallurgical properties of the bomb body.

2. It is concluded that:

- a. The maximum STS armor plate thickness which the normalized bomb will penetrate and remain in effective bursting condition, at a velocity of 1000 ft./sec. and 20° obliquity, is nominal 1"25 plate, as reported in NPG Confidential Report Number 748. Bomb body deformation is probably not severe enough to cause deflagration of an explosive filler.
- b. Under the same conditions, the corresponding thickness for the quenched and drawn bomb is nominal 1938 STS armor plate. The two rounds fired under the above conditions remained effective and intact. Body deformation was probably not severe enough to cause deflagration of an explosive filler. It appears that the heat treated bomb will penetrate a greater thickness of STS armor plate than will the bomb finished by normalizing.
- c. The maximum thickness of reinforced concrete which the heat treated bomb will penetrate and remain in effective bursting condition, at 1000 ft./sec. striking velocity and 20° obliquity, is 24 inches. Two bombs were fired satisfactorily under these conditions. Two additional bombs fired at 30 and 36 inches of reinforced concrete were not effective, both bombs breaking into two pieces.
- d. No bombs finished by normalizing were fired at reinforced concrete during this test. However, from the results of a previous test as reported in NPG Report Number 748, it is apparent that under the same conditions the maximum thickness of reinforced concrete for the normalized bomb is also 24 inches.

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NPG REPORT NO. 1073

Ballistic Tests of 1000# Low Drag, G.P. Bomb Type EX 10 Mod 12

- e. Bombs heat treated by quenching in oil from 1500°F and drawing at 1100°F followed by a water quench have better ballistic qualities than those produced by normalizing only.
- f. Quenched and drawn bombs have lower temperatures of transition from ductile to brittle behavior and thus would be more effective at low temperatures than normalized bombs.
- 3. It is recommended that the design of the nose fuze hole be reviewed for the purpose of strengthening the structures at this point.

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PART B

INTRODUCTION

AUTHORITY: 1.

These tests were authorized by reference (a) and conducted under Task Assignment NPG-Re3c-321-1-52.

2. REFERENCES:

- BUORD Conf ltr Re3c-LME:edb NP9 Ser 25671 of 14 Sep 1951
- Task Assignment NPG-Re3c-321-1-52 IPG Conf Report Number 646 C 55665
- NPG Conf Report Number 748
- National Tube Co. Preliminary Sk. Number 142 e.

BACKGROUND: 3.

In the development of a family of low drag bombs for external suspension on high speed aircraft, the Naval Proving Ground has conducted plate penetration tests and metallurgical examination on the 1000 lb. Low Drag G.P. Bomb Type EX 10 and Type EX 10 Mod 3. Reference (c) is a report on the performance of 1000 lb. Low Drag G.P. Bomb Type EX 10 together with recommendations for heat treatment of this bomb case to improve its metallurgical properties. Reference (d) is a report on the performance of 1000 lb. Low Drag G.P. Bomb Type EX 10 Mod 3 together with recommendations for heat treatment to improve its metallurgical properties. The Type EX 10 Mod 3 bomb differed from the Type EX 10 bomb in that inserts for screw-in suspension lugs were provided in the bomb body, the nose section of the bomb body was heavier, and the thread diameter of the nose fuze hole was increased to three inches.

This report deals with the performance of 1000 lb. Low Drag G.P. Bombs Type EX 10 Mod 12 in the heat-treated and in the normalized condition.

OBJECT OF TEST:

These tests were conducted to determine:

The maximum armor plate or concrete thickness which each type of bomb will penetrate and remain in an effective bursting condition.

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NPG REPORT NO. 1073

Ballistic Tests of 1000# Low Drag, G.P. Bomb Type EX 10 Mod 12

- The degree of acceptable deformation of each type of bomb resulting from impact.
 - The condition under which each type of bomb will fail.
 - The chemical and metallurgical properties of the bombs.

PERIOD OF TEST:

- a. Date Project Letter
- b. Date Commenced Test
- c. Date Completed Test

- 14 September 1951
- 5 October 1951 5 November 1951

PART C

DETAILS OF TEST

6. DESCRIPTION OF ITEM UNDER TEST:

Twenty 1000 1b. Low Drag G.P. Bombs Type EX 10 Mod 12 described by reference (e), which is included as Figure 10 in this report. The Type EX 10 Mod 12 bombs differ from Type EX 10 Mod 3 bombs in that the threads for the nose fuze hole have been increased to 3-1/2" diameter. In addition, ten of the EX 10 Mod 12 bombs were submitted for test with heat treatment as recommended by references (c) and (d); that is quenched in oil from 1500°F and drawn at 1100°F, followed by a water quench. The remaining ten bombs were submitted for test in the normalized condition to conform to the treatment given the Type EX 10 and Type EX 10 Mod 3 bombs in order that comparative tests might be conducted between normalized and heat treated bombs.

The twenty EX 10 Mod 12 bombs used in this test were inert loaded with a vermiculite-cement filler of 1.55 specific gravity.

7. DESCRIPTION OF TEST EQUIPMENT:

14"/50 Mk 11 Mod 0, No. 119L-2

Various weights of Sphero-Hexagonal Black Cannon Powder

Nominal 1-1/4", 1-3/8" and 1-1/2" STS armor plate 24", 30" and 36" structural concrete reinforced 3 ways with Targets:

3/4" rod on 6" centers.

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8. PROCEDURE:

The bombs were fired against STS armor plate targets of various thicknesses at velocities ranging from 838 ft./sec. to 922 ft./sec. The heat treated bombs were fired against the reinforced concrete targets at velocities ranging from 874 ft./sec. to 890 ft./sec. All tests were conducted with the target at 20° obliquity. The targets were secured in heavy butts and backed by a sand pile, which served as the recovery medium. Each type of bomb was recovered after firing and examined prior to firing the next test on this program. Velocities were measured in the standard manner, using solenoids and oscillographs. Samples were cut from each of the following listed bombs for metallurgical examination: NORM-2, NORM-9, Q & D-11, and Q & D-18.

9. RESULTS AND DISCUSSION:

- a. Ballistic test conditions and results are given in detail in Tables III through XIV of Appendix (B) and Figures 1 through 9 of Appendix (C) and are summarized in Tables I and II of Appendix (A). Briefly, the results were as follows:
- (1) Four of the normalized bombs were fired against STS armor. The first bomb was fired against 1.21 STS armor at 838 ft./sec. and was recovered in effective condition with moderate flattening on the body nose section. The next two bombs were fired against 1.38 STS at striking velocities of 922 ft./sec. and 865 ft./sec. Both bombs were recovered in ineffective condition, one being cracked from the nose to 26" back and the other having the nose section bent and broken open. The fourth round was fired against 1.21 STS at 899 ft./sec. and was recovered in an ineffective condition with the nose broken off. As a result of these tests, it was considered that the plate limit of the normalized 1000 lb. Low Drag G.P. Bomb Type EX 10 Mod 12 at these test conditions was less than nominal 1-1/4" STS armor plate.
- (2) Four of the heat treated bombs were fired against STS armor plate. The first bomb was fired against 1"21 STS armor at 911 ft./sec. and was recovered in effective condition with moderate to severe flattening of the nose body section. The second bomb was fired against 1"38 STS armor at 855 ft./sec. and was recovered in effective condition with moderate flattening of the bomb body. The third round was fired against 1"50 STS armor at 872 ft./sec. and was recovered in ineffective condition being bent with the nose broken off. The fourth round was fired against

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1.38 STS armor at 850 ft./sec. and was recovered in effective condition although severely worked on the nose section. As a result of these tests, it was considered that the plate limit of the heat treated 1000 lb. Low Drag G.P. Bomb Tvpe EX 10 Mod 12 at these test conditions was nominal 1-3/8" STS armor plate.

(3) Four of the heat treated bombs were fired against reinforced concrete targets. The first bomb was fired against 24" reinforced concrete at a striking velocity of 888 ft./sec. and was recovered in effective condition with very little body deformation. The second bomb was fired against 36" reinforced concrete at 890 ft./sec. and was rendered ineffective as the bomb broke into two pieces in the target. The third bomb was fired against 24" reinforced concrete at 874 ft./sec. and was recovered in effective condition with very little body deformation. The fourth round was fired against 30" reinforced concrete at 886 ft./sec. and was rendered ineffective as the bomb broke into two pieces in the target. As a result of these tests, it was considered that the heat treated 1000 lb. Low Drag G.P. Bomb Type EX 10 Mod 12 would penetrate in effective condition 24" reinforced concrete.

b. Metallurgical Examination

Metallurgical examination was made of normalized bombs #2 and #9 and quenched and drawn bombs #11 and #18 shown after firing in Figures 2, 5, 2 and 8 respectively. The examination consisted of chemical and spectrographic analysis, tensile, Charpy impact and Brinell hardness tests, hot acid etch and microscopic examination. The test samples were cut from the least damaged sections of the side walls of the bombs after firing.

The results of chemical and spectrographic analyses were as follows:

Bomb No.	<u>C</u>	$\underline{\mathrm{Mn}}$	<u>P</u>	<u>s</u>	<u>Si</u>	Mo	Cr	<u>Ni</u>
2 NORM	•42	1.75	.016	.021	.22	•32	.08	Trace
9 NORM	•34	1.37	.020	.021	.18	•31	•09	11
11 Q &D	.41	1.64	.016	•024	.18	•29	.09	11
18 Q&D	•37	1.64	.016	.021	.21	•32	.10	11

Longitudinal tensile test and average Brinell hardness results are shown below:

Bomb No.	Yld. Str2% p.s.i.	Ult. Str. p.s.i.	Elong. <u>%1.4"</u>	R.A.	B.H.N. 3000 Kg.
#2 NORM	95500	123670	17.9	49.3	251
#9 NORM	65850	101670	23.1	53.2	202
#11 Q&D	90870	119670	20.2	61.9	249
#18 Q&D	107500	127000	17.5	58.1	270

The tensile test results are averages of three specimens from each bomb.

Longitudinal Charpy V-notch impact tests with the notch normal to the plate surface were made in duplicate at 100°C, +25°C (room temperature), 0°C, -40°C and -78°C excepting for bomb #2. On this bomb, the testing at -78°C was omitted and additional tests were made at +65°C and +45°C. The results of impact tests are shown in Table XV and Figures 11 and 12, Appendix (E).

Transverse sections etched for 20 minutes in 50% HCl- 50% H₂0 at 160°F are shown in Figure 13.

Typical microstructures at 250X and 1000X are shown in Figures 14 to 21, inclusive. Chemical analyses represent a nonstandard manganese - molybdenum steel which is similar in composition to the analysis of previous bombs reported in references (c) and (d). The analysis of bomb #9 is somewhat lower in carbon and manganese contents which accounts for its softer physical properties. The tensile properties of the quenched and drawn bombs are not appreciably different from those of the normalized bombs previously examined, bomb #18 being only slightly harder. However, the beneficial effects of the quenched and drawn heat treatment manifests itself in the tempered-martensitic microstructure in Figures 18 to 21, inclusive, and in the combination of higher values of tensile, hardness and impact strengths exhibited by bombs #11 and #18. The deep acid etch tests as shown in Figure 13 indicate sound steel in all four bombs.

Considering the points on the Charpy impact curves in Figures 11 and 12, where the fractures become 50% granular and 50% fibrous as the transition points between toughness and brittleness, it will be noted that the normalized bombs #2 and #9 become brittle at temperatures of approximately plus 25°C and 0°C respectively, whereas the quenched and drawn bombs #11 and #18 become embrittled at approximately minus 50°C and below minus 78°C respectively. This indicates that the quenched and drawn bombs will be more effective at sub-zero temperatures than the normalized bombs.

PART D

CONCLUSIONS

10. It is concluded that:

- The maximum STS armor plate thickness which the 1000 lb. Low Drag G.P. Bomb Type EX 10 Mod 12 in the normalized condition will penetrate and remain in effective bursting condition, at velocities ranging from 838 ft./sec. to 922 ft./sec. and 20° obliquity, is less than nominal 1-1/4" plate. This is to be compared with the 1000 lb. Low Drag G.P. Bomb Type EX 10 Mod 3 which effectively penetrated nominal 1-1/4" STS armor plate at the same test conditions. Both Mods of these Type EX 10 bombs are in the same heat treated condition, the only design difference being in the thread diameter of the nose fuze hole. Since the failures of the Type EX 10 Mod 12 bomb originated from or around the nose fuze hole, it is concluded that increasing the diameter of the nose fuze hole from 3" in the Type EX 10 Mod 3 bomb to 3-1/2" in the Type EX 10 Mod 12 bomb has resulted in decreasing the thickness of STS armor plate the bomb will penetrate in an effective condition.
- b. The maximum STS armor plate thickness which the 1000 lb. Low Drag G.P. Bomb Type EX 10 Mod 12 in the heat treated condition will penetrate and remain in effective bursting condition, at velocities ranging from 850 ft./sec. to 911 ft./sec. and 20° obliquity, is nominal 1-3/8" plate.

- c. The maximum thickness of reinforced concrete the 1000 lb. Low Drag G.P. Bomb Type EX 10 Mod 12 in the heat treated condition will penetrate and remain in effective bursting condition, at velocities of 874 ft./sec. and 888 ft./sec. and 20° obliquity, is 24".
- d. Bombs heat treated by quenching in oil from 1500°F and drawing at 1100°F followed by a water quench have better ballistic qualities than those produced by normalizing only.
- e. Quenched and drawn bombs have lower temperatures of transition from ductile to brittle behavior and thus would be more effective at low temperatures than normalized bombs.

PART E

RECOMMENDATIONS

11. It is recommended that the design of the nose fuze hole be reviewed for the purpose of strengthening the structure at this point.

The tests upon which this report is based were conducted by: W. W. NEYERS, Plate Battery Officer

Terminal Ballistics Department

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Captain, USN

Ordnancé Officer

By direction

U. S. NAVAL PROVING GROUND DAHLGREN, VIRGINIA

Fiftieth Partial Report

on

Bombs and Associated Components

Final Report

on

Ballistic Tests of 1000% Low Drag, G.P. Bomb Type EX 10 Mod 12

JAN 221953

Date:

Project No.: NPG-Re3c-321-1-52

Copy No.: 29 No. of Pages:

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TABLE I
Summary of Firing Conditions and Ballistic Test Results

Imp.	Bomb No.	Obl.	Thick- ness	Str. Vel. ft./sec.	Penet.	Thru <u>Open</u>	Condition
39328	NORM-1	20	1421	838	C	14°° X14°°	Effective and intact. Moderate flattening.
39329	Q&D-12	20	1721	911	С	14**X14**	Effective and intact. Moderate to severe flattening.
39334	NORM-2	20	1838	922	С	1488X1488	Severely bent and drawn-sides flat- tened, cracked long from nose to 26" aft.
39335	Q&D-11	20	18 38	855	C	14°° X14°°	Effective and intact. Moderate flattening.
39351	NORM-4	20	1438	865	С	14 ¹⁷ X14 ⁹⁸	Not effective bent and broken open on nose section.
393 52	Q&D-13	20	1\$50	872	С	14"X14"	Not effective- bent and broken open on nose section.
39364	Q&D-14	20	1738	850	C	14"X14"	Effective and intact. Severely worked on nose.
39365	NORM-9	20	1421	899	С	14"X14"	Not effective- broken open on nose.
39376	Q&D-19	20	24 ⁹⁹	888	C	18"X18"	Effective and intact. Very slightly bent and worked.

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APPENDIX A

TABLE I (Continued)

Imp. No.	Bomb No.	Obl.		Str. Vel. ft./sec.	Penet.	Thru <u>Open</u>	Condition
39387	Q&D-17	20	36 ¹¹	890	35 ¹¹	15"X20"	Bomb broke into 2 pieces. Nose through and off. Base stuck in block.
39416	Q&D-18	20	2411	874	C	19"X21"	Effective and intact. No. deformation.
39438	Q&D-20	20	30#	886	Inc.	811X1011	Bomb broke into 2 pieces. Nose through and off. Base stuck in block.

TABLE II

Comparison of Heat Treated Bombs

Norm	nalized			Quenche	ed and	Drawn
1421:	838	OK		1421	911	OK
1438	922	NG		1438	855	OK
1438	865	NG		1450	872	NG
1421	899	NG		1438	850	OK
				2411	888	OK
				3611	890	NG
				24**	874	ok
				3011	886	NG

U.S. Naval Proving Ground

IMPACT No. 39329 IMPACT DATE 16-5-51 BUTT No.

Dahlgren, Va. 16-5-51 194 OBJECT BELLIEVE TEST OF MEST LE. LOCK DEBE ROME I'IIE EX.16

Reference N.	.P.G.: L ET	TER		710.1	623_DA	TED					
	PLATE			A mile		ROJECTILE					
Gauge / 1.550				Caliber/ Maker//	12.97						
Class 75 Maker 1,5,5,7,7 No. 145191		··		Maker //	T. Co.	······································					
Maker / Corre	1			Maker <u>//</u> Type <u></u> 子, Lot No	P. Lou'	PEAS					
No. 145691	Group /	1-526-7	118	Lot No	- Year	of Specificat	tion -				
Contract N600 - 15:	- 9i	728	markan akkan a	Mark EX-10	Mod.	/2. No	D. D+ Q-12				
Date received 4-3				Date receive	ed .		·				
Dimensions 250"	X 83	1/2"		-Gapped-or uncapped							
No. of impact on plate	4.		-	Weight (capped) Weight (uncapped) 984							
No. of impact on plate. Thickness at impact	1,	2/		Weight (unc	apped)	934 #					
OBLIQUITY	20	à	•	· Length (uncapped) 78,80							
Impact dimensions	14:3	115"		Fuze	NONE						
PENETRATION	Com	11275		Fuze Now Filler VERMICELITE							
Flaking front		,		Flight by screen							
				Condition af	ter firing:-						
Flaking back Dist. from top, better Dist. from right, left	mm))		EFFECTI	VE or INE I	FFE(TIVE	\wedge				
Dist. from right, lef t	<u></u>	, 1 m					/ \				
Disc. Hom hearest m	ipact -	α		moderar	E & A	enere	_ (
Dish 4/Spur 6/2 Cracks - Bulge	<i>'</i> }			Rallen	ingi						
Spur	· · · · · · · · · · · · · · · · · · ·		_ 								
Cracks - Bulge	<u> </u>										
Button (Thrown)(Stea Through Opening	eted)										
Through Opening	14"	14"									
					BALLISTI	C DATA					
Note:	-1-	-2-	-3-	-4-	-5-	-6-	-7-				
All limits are for this	Desired	Oscillograph	Chronograph	for this thickness		gauge, based on	Limit, for nominal gauge, established				
plate and this obliquity	•			of impact,		this impact only.	from column 6 and previous impacts.				
only.		11:11AM				calumn 4)					
Striking velocity (f.s.)		811									
REMARKS											
		- /,									
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SECURITY INFORMATION

TABLEIN

N.P.G. Photo, No. Pt. 1990 S

GUN: 14"/50 115 11000 # 11962

U.S. Naval Proving Ground

IMPACT No. 39334 IMPACT DATE 10-9-51
BUTT No. B

Dahlgren, Va. 10-9-51

OBJECT BALL		TEST	-OF 10	200 LB. L	OW DRA	5 6, P. 1	Bome :			
		FER O	1120-	no. 10	23 DA	TED				
	PLATE			Bonit	•	OJECTILE				
Gauge //38				Caliber	13.976					
Class 575					I.T. Co.					
Maker EARRES	-12-			Type						
No. 045701	Groun	1-526-	205		Year		tion			
Contract ORDER: 439-5			270	Mark. FX						
Date received SEPT		1944		Date receive			MILE ELLO			
Dimensions 95 1/16		49 1/2"		Capped or uncapped						
No. of impact on plate		77/2		Weight (capped)						
Thickness at impact	/ _{1.0}	38		Weight (uncapped) 931,50#						
OBLIQUITY	901	7.		Length (uncapped) 737,30 #						
Impact dimensions	111 " 1	150		Fuze	<u> </u>	- · · · · · · · · · · · · · · · · · · ·				
PENETRATION		PLETE		Filler	VERN	16 10 15 K				
Flaking front		F 5 5 5 C		Flight by scr		A Sinter production of				
Flaking back	1			Condition af						
Dist. from top, -bette	m 9	911			VE or INE	FECTIVE	. \			
Dist. from right, left		8"					/\			
Dist. from nearest in				Parent	Ro F	1 de	_ ()			
Dish		13		2. 0. 5	P. Francisco	a confo				
	11 11			I I	FA	a start	-			
Cracks - Bulge	7			211/20	<u> </u>	75W				
Button (Thrown)(Sta	~~									
Through Opening		¥14"								
		1./.			BALLISTI	CDATA				
N.T. o. o. o. o.	1 .	1	-3-	1	-5.	-6-				
Note:	-1- Desired	-2- Oscillograph	Chronograph	-4- Limit, estimated	T	•	Limit, for nominal			
All limits are for this plate and this obliquity	Deaned	Oscinograpii	Cinonograpii	for this thickness of impact.	to nominal gauge.	gauge, based on this impact only. (Adjusted from	gauge, established from column 6 and previous impacts.			
only.		MEAN				column 4)				
Striking velocity (f.s.)		922								
Remarks										
- 1 4 4 4 4 4 4 7 4 4 7 4 7 4 7 4 7 4 7 4										
		Rivit		MAL -		D.1				
Limit shots only	St. I Villain	and the grade	f in the state of	(是是是) 一	Acceptance or	Rejection-rec	ommended			
e/d	332A &	MILA W	上自己的	TION						
F(e/d, Θ)				- ***	UUILEA	Alaber O				
N.P.G. Photo. No. NF	5139	7			Will	! WEL	UrS Navy			
14.1.(1. 1 1000) 140, (23	1 / 1 / 1 / 1 / 1 / 1 / 1 / 1 / 1 / 1 /	1	المحاسب ووا	00- #11	910	FABL	U.S. Navy			
(1)H	7 : 147	50 /11K	. [[7]](0D - #!!	7 m de					

U. S. Naval Proving Ground
Dahlgren, Va. 10-9-51 194

IMPACT No. 39335 IMPACT DATE 10-9-51 BUTT No. B

OBJECT PALLISTIC TEST OF 1000 LOW DRAG G.P. BOMB

Reference N	P.G. LEF	FER >	in the same	Time Isi	DA	TED							
	PLATE		1	Bomb	P I	OJECTILE-							
Gauge //38			(Caliber	13.997								
('lass 575				Maker									
Maker CARRESIE		······································		Type		DEAK							
No. 645701		7-526-		Lot No			tion -						
Contract BRDEK - 4:				Mark FX									
Date received SEPT		1944		Date receive									
Dimensions 95-11		249.1/2		Capped or ur									
No. of impact on plate				Weight (capped)									
Thickness at impact	1:38	>		Weight (uncapped) 928, 7#									
OBLIQUITY	BLIQUITY JOS					Length (uncapped) 78,70#							
mpact dimensions 14"x 15"				F1170 A/A A/2-									
PENETRATION COMPLETE				Filler VERMICULITE									
Flaking front	0			Flight by scr	een								
Flaking back	Ø.			Condition af									
Dist. from top, botto	m 6	7"		EFFECTI	VE or INE	FECTIVE	\wedge						
Dist. from right, lof t		? <u>^</u>				-	/ \						
Dist. from nearest in	npact <u>3</u> :	3 "		madera	te flat	lenny.	()						
Dish	<i>3"</i>					<u></u>							
Spur	<u> </u>		, ·				-						
Cracks - Bulge	0		 .			·							
Button (Thrown)(Star	40					, , ,							
Through Opening	14".	14 9 .		, 		, a	, .						
		•		*	BALLISTI	C DATA							
Note:	-1-	-2-	-3-	-1-	5	-6-	-7-						
All limits are for this	Desired	Oscillograph	Chronograph	1	to commal gauge.	gauge, based on	Limit, for nominal kauge, established						
plate and this obliquity				of impact.	į	this tropact only, [Adjusted from [from column 6 and previous impácts.						
only.		DIEAN				column 4)							
Striking velocity (f.s.)		855				,							
Kemarks				•		* . *	** **********************************						
, , ,				•			***						
							ரிகள் வரைச						
	~~	****	~ #****	TIT A T									
Limit shots only	CO	NET	JEN	MAL	Acceptance or	Rejection rec	ommended.						
	CECT	URITY II	NEORM!		receipedince or		· · · · · · · · · · · · · · · · · · ·						
e/d	. BECU	URLL I	CAT FARMAN		TATATA	A							
F(e/d, (-))	 				The state of the s	GULVY S.							
N.P.G. Photo, No. N	5139	7			CERCA	ME .	fagin fair market						
	•	m1 1	1 mand	_ #119	12	IAR	LE Y						

U.S. Naval Proving Ground .
Dahlgren, Va. 16-11-3-1 194

IMPACT No. 39351
IMPACT DATE 10-11-51
BUTT NO. 8

OBJECT BALLISTIC TEST OF 1000 LB. G.P. LOW DRAG

Reference N	.P.G. LET	PER 6	K . pr few	724.10	-3DA	TED	· · · · · · · · · · · · · · · · · · ·				
	PLATE		-	BomB	791	OJECTILE					
Gauge //38				Caliber	1.3.07	7.					
Class <u>575</u>		·		Maker	1. T. C.A	*					
Maker CARNES	1 /			Type &.	P. Inis	IDEAL					
No. 045701	Group (9-50/-	397	Type	Year	of Specifical	tion —				
Contract ORDER - 4			and fields a	Mark FX	10 Mod.	Ja. No	Makm. H				
Date received 5FP				Date receive	d —	:	YYEZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZZ				
Dimensions 9516"	VOU	alain	• ,	Sameda r ur	capped						
No. of impact on plate	•			Capped or uncapped							
Thickness at impact	1130	<u>.</u>		Weight (uncapped) 938 0#							
OBLIQUITY	2000	<u> </u>		Weight (uncapped) 938.0# Length (uncapped) 78.70"							
Impact dimensions	1110 11	10-11		Fuze NonE							
PENETRATION		Filler VERTICULITE									
Flaking front				Flight by scr	een	lost to	***************************************				
Flaking back				Condition af	ter firing:						
Dist from ton botto	m 3	. **			VE_or_INE	FEECTIVE	\wedge				
Dist. from top, botto Dist. from right, left	****	8"		DI I DOIL	11 (1)						
Dist. from nearest in	nact	?>"		P. d.	or 0.	Fa . d	_ / . /				
Dish 3"				Bent an	e sea						
Spur 7"				m and	and the second	con d	 .√				
Cracks - Bulge	?			,		···					
Button (Thrown)(Star	etad)						-				
Through Opening				· · · · · · · · · · · · · · · · · · ·	· · · · · · · · · · · · · · · · · · ·	,					
intough Opening	14 X	<u> </u>			DALLICTI	C DATA					
	· · · · · · · · · · · · · · · · · · ·		1	<u> </u>	BALLISTI						
Note:	-1-	-2-	-3-	-4- Limit, estimated	-5- Actual, adjusted	-6- Limit, for nominal	-7- Limit, for nominal				
All limits are for this	Desired	Oscillograph	Chronograph	for this thickness		gauge, based on	gauge, established				
plate and this obliquity		•		of impact.		this impact only. (Adjusted from	from column 6 and previous impacts.				
only.		MEAN			•	column 4)					
Striking velocity (f.s.)		865									
Remarks	' - 	, , ,	<u> </u>	·	• • •	<u> </u>	ļ				
TUBIRIO											
				· · · · · · · · · · · · · · · · · · ·							
		N 78 7 77 7 7 7 7 7 7 7 7 7 7 7 7 7 7 7	****				*				
			1-1-1-1-1	FT-7-X-2		,					
Limit shots only	SECT	PHILA II	The state of the s	TIAL	receptance or	Rejection rec	om mende d				
e/d			NFURAL	ATHON							
F(e/d, ⊗)				24	MATT	en ava					
At	1 7.200				10 rd 5	All I	II S. Nos-				
N.P.G. Photo. No. N.P.	11270				122261		TATAL				
CUN;	14"/	50 M	K 11 1	100 - H	Inty M Ind S 1/912	IAB	LE Yould				

U.S. Naval Proving Ground Dahlgren, Va. 10-11-51 19 IMPACT NO. 39352.
IMPACT DATE 10-11-51
BITT NO. B

OBJECT BALLISTIE TEST OF 1000 LB. G.P. LOW DRAGE BOTHE TYPE EX 10

Reference N	.P.G. 上 学	神化 つ	1	R L E	-3 D/	ATED .					
	PLATE			BomE	-P 1	ROJECTILE					
Gauge 1."50				ā i T	13,973	,*					
Class 573		7-60 to m2 -	•		VIT. Co.	*	n - Auge no				
Maker LANTED 3	TELL			Type 6	P. Lou	DEAG					
No. 022615	Group	11.52%		Lot No.							
('ontract N-600-13				Mark EX. [
Date received 4			-	Date receive	1	en de seus de la maior de la company	•				
Dimensions 95"				Capped-or ui	icapped						
No. of impact on plate				Weight-tempect							
Thickness at impact	1."	50		Weight (uncapped) 9/7,0							
OBLIQUITY	200			Length (uncapped) 18.20"							
Impact dimensions	15" X	16"		Fuze NONE							
PENETRATION		Filler VEK 17118-6-2-17-E									
Flaking front	0			Flight by screen							
Flaking back	Ö			Condition after firing:-							
Dist. from top, botto	m 5	8"			VE or INE	FFECTIVE	\wedge				
Dist. from right, left	14	4'									
Dist. from nearest in	npact	39"		Bent as	d brok	an open					
Dish	3'	,	•		a sect						
Spur	5,,										
Cracks - Bulge	0										
Button (Thrown) (Sta	rted)										
Through Opening	14"	X14"									
•					BALLISTI	C DATA					
Noir:	-1-	-2-	-3-	*4-	5	-6-	-7-				
All limits are for this	Desired	Oscillograph	Chrososcaph			I mut, for nominal practice, based on					
plate and this obliquity				et a port		th importants t t Aducated from	from column 6 at d				
only.	} -	MEAN		Í		* серапет 41					
Striking velocity (f.s.)						· 					
		872.	<u> </u>		<u> </u>	1					
REMARKS		•					•				
•					- • •						
:	Mand Strant as	\ 7 7 7 1 4 7 7	فالماعة أهداف	按 、 =		•	•				
-		. III.	16.24								
Limit shots only	SRCU	MY YEL	703367	. 1	Acceptance or	-Rajoution-rec	e mmend ed				
e/d					·						
F'(e/d, ω)	-			•	WWW	News 200					
	3 6.2	40			Tank.	~ C*	Limiteration				
N.P.G. Photo, No. NP	7-212	17			(Martill)	- 6 cm	TYPE				
	. 1/2	100 Mi	45 /4 N	100-#	11912	148	. In the Mandalaste				

U. S. Naval Proving Ground

IMPACT NO. 393 (1)
IMPACT DATE 16-15-51
BOTT NO. #

Dahlgren, Va. ./6-15-5/ +94-

	F 1000 LB. G.T. LOW DEAG
Property N.D.C. FETTER A 4.2 C	t 720 1073 DATED
· · ·	Series (L)
PLATE	. PROJECTIBLE
(lauge 1.38	Caliber 14"
Class	Maker N.T. Co.
Maker CARNEGIE	Type 6, P. Low TRACT Lot No. Year of Specification
No. <u>045701</u> Group <u>C_526_39</u> 2	Lot No. Year of Specification
Contract ORDER-437-5-5000-C	Mark EX10 Mod. 12 No. DY 614
Date received 5=67. 11, 1944	Date received
Dimensions 95 /16" x 249 /2"	- Capped o r uncapped
No. of impact on plate	Weight (capped)
Thickness at impact 1,38	Weight (uncapped) 938.6#
OBLIQUITY 20°	Length (uncapped) 78.40"
Impact dimensions 14" X 15"	Fuze Marker.
PENETRATION Complete	Filler VFK711/1/17 F
Flaking front	Flight by screen
Flaking back	Condition after firing:-
Dist. from top, bettom	EFFECTIVE or INEFFECTIVE \
Dist. from right, left /23"	
Dist. from nearest impact 36"	Severaly warpen on mind
Dish 2"	
Spur 8"	
Cracks-Bulge	
Button (Thrown)(Sterfed)	
Through Opening 19" X 16"	
	BALLISTIC DATA.
Note: -123	-45 -67-
All limits are for this Desired Oscillograph Chronos	samph Limit, estimated Actual admisted Limit, for nominal for this thickness to reamped cause, gauge, based on gauge, established
plate and this obliquity	of impact the impact only. from column 6 and
only.	t Adjusted from previous sinpacts column 44
Striking velocity (f.s.)	
Bunking velocity (1.83)	
Remarks.	
	The second of th
CONFID	ENTIAL
SECURITY INI	FORMATION
Limit shots only	Acceptance or Rejection recommended
e/d	
F(e/d, Θ)	Willand
1100 ri209	(Shi Sun
N.P.G. Photo. No. NP9 51398	et 11001 of the Table 1x
60N: 14"/50 MK11	#/19/2 TABLE 1X

F	7ile	No.) .
1	. 116	: 140)

U.S. Naval Proving Ground

IMPACT No. 39365
IMPACT DATE 10-16-51
BUTT No.

Dahlgren, Va. 16-16-51 194 OBJECT EARLISTIE TEST OF 16 11/16. E.P. LOW CKPE 1:07118 REFERENCE N.P.G. LETTER 16 23 DATED KomE. PLATE PROJECTILE Caliber ____ Gauge 1.55 Class 575 Maker N. T. Cc. E.P. LOW TAKE Maker U.S. STEEL Type ____ Lot No. _____Year of Specification_ No. C45690 Group 25-26-418 Mark FX 10 Mod. 15 No. NO. 111-9 Contract N660 - 1553 - 99 78 Date received 4-25-51 Date received -Dimensions 88" X 550 Capped or uncapped Weight (capped) No. of impact on plate Weight (uncapped) ____931, ^ Thickness at impact OBLIQUITY SALE Length (uncapped) Impact dimensions 14" V/6" PENETRATION DEPT. ETF Filler VEK NOW TY Flaking front____ Flight by screen Flaking back Condition after firing:-Dist. from top, bottom EFFECTIVE or INEFFECTIVE Dist. from right, left //8" Dist. from nearest impact Dish____ Spur Cracks - Bulge Button (Thrown)(Started) Through Opening 14" X 15" **BALLISTIC DATA** NOTE: -7--1--4-Limit, for pominal Limit, for nominal Limit, estimated Actual. adjusted Desired Oscillograph Chronograph All limits are for this for this thickness to nominal gauge, gauge, based on gauge, established of impact. this impact only. from column 6 and plate and this obliquity (Adjusted from previous impacts. only. column 4) Striking velocity (f.s.) SECURITY INFORMATION Acceptance or Rejection recommended Limit shots only e/d______ F(e/d, \text{\tin}}}}}} \ext{\tin}\tint{\text{\text{\text{\text{\text{\text{\text{\text{\text{\tin}\tint{\texi}\tinz}{\text{\text{\text{\tin}}\tint{\text{\text{\text{\text{\tin}\tint{\text{\text{\text{\text{\text{\text{\text{\text{\text{\texit{\text{\text{\text{\text{\texid}\tint{\text{\text{\texi}\ti}\tint{\tint{\text{\ti}}}}\tint{\text{\tiin}\tint{\tin}\tint{\ti NP9-51400 GUN: 14 /50 MK. 11 #11912 N.P.G. Photo. No. NP9-51400

						,	
File No		D.,++	Fixing	Імр	ACT NO. 3	4376	
•			Firing	Тмр	ACT DATE	0-1851	
	U.S.	. Naval Pr	oving Ground		rt No.		
	Dahlg	ren, Va	10-18-51	194.	II INO,	••••••	
Garles	رسوس بدر	را المعلقة الماسية	* / * * * *	ر صرا	·		
Овјест /6/41/-157					T + F.		
REFERENCE N.P.G. LET	EER 51.	10 1816 100 15 T	720 /	773 DA	ATED		
-PLA TE		J			ROJECTILE		
Gauge 34" Caparati		,	Korn B Caliber	. 11			
Class	1. LOCK	<u>*</u>	Maker	13,974 N.T. Co	<i>,</i>		
Maker			Type				
No. No Number Group					of Specifica		
Contract			Mark <u>Ex 10</u>				
Date received			Date receive			· <u>[2] [2] =</u> []	
Dimensions 10' × 10	,						
No. of impact on plate			Capped-or-uncapped Weight (capped)				
No. of impact on plate	·,		Weight (uncapped) 933.4.				
OBLIQUITY 20°			Length (uncapped) 78.56				
Impact dimensions // V	27"		Fuze NowE				
PENETRATION COMP			Filler				
Flaking front 50" y 5	9"		Flight by scr		· · · · · · · · · · · · · · · · · · ·		
Flaking back 52 / 68	n "		Condition af		-		
Dist. from top, bettom	77"			VE or INE	FFECTIVE	\wedge	
Dist. from right, left	8"		Intra.	funto -			
Dist. from nearest impact	0	·			1	_ (
Dish			Very	chechtin	benl		
Spur			0	0			
Cracks - Bulge ()		•					
Button (Thrown)(Started)							
Through Opening 15" Y	14"				-		
			· · · · · · · · · · · · · · · · · · ·	BALLISTI	C DATA		
Note: -1-	-2-	-3-	-4-	-5.	-6-	-7-	
All limits are for this	Oscillograph	Chronograph	Limit, estimated for this thickness	Actual, adjusted to nominal gauge.	Limit, for nominal gauge, based on	Limit, for nominal	
All limits are for this plate and this obliquity			of impact.	to nominar gauge,	this impact only.	from column 6 and	
only.	Marak	1		•	(Adjusted from column 4)	previous impacts.	
	DIFFIN		1				
Striking velocity (f.s.)	1888	L			<u>, </u>	1	
REMARKS Brank 771		for.	- Huma Fo	Zee-	E. F. 10 . 10 . 30 . 30 . 50		
-Block Bar-3	23	A STATE OF THE STA	there of				

entire Bout and whitehed and unteret very CONFIDENTIA Arceptance of Rejection recommended Limit shots only e/d______ F'(e/d, ⊗)

N.P.G. Photo. No. NP9-51401

SECURITY INFORMATION ___ U.S. Navy

: GUN: 14"/50 MK 11 MODO # 11912

TABLE XI

File No.	
Butt	Firing IMPACT No. 3 9 3 8 7
•	IMPACT DATE / OTXQ TQ/
	Proving Ground BUTT NoB
	10/25/195/194
OBJECT SALATIOTIC TEST	OF 1000 Lb G.P. LOW DRAGE
Bomb MK Ex10-12	
REFERENCE N.P.G. LETTER	7 72011/073 DATED
PLATE	PROJECTILE
Gauge 36" CONCRETE BLOCK	Caliber 14" Bomb
Class	Maker N.T. C.D
Maker	Type G.P. LOW DRAG
No. // Group	Lot No. Year of Specification
Contract	Mark Fx 10 Mod. 12 No. D+0-17
Date received	Date received
Dimensions	Capped or uncapped
No. of impact on plate/ i:	Weight (capped)
Thickness at impact3 6"	Weight (uneapped) 943.0
OBLIQUITY 20°	Length (uncapped) 78."65
Impact dimensions 36" x 3 7"	Fuze NONE
PENETRATION PARTIAL	Filler VERMIZULITE
Flaking front 70" x 80"	Flight by screen
Flaking back NONE	Condition after firing:-
Dist. from top, bettom 82"	EFFECTIVE or INEFFECTIVE
Dist. from right, left 41"	
Dist. from nearest impact	Broke into two
Dish	pleas - Nose Through
Spur None	land gate Pouce starker
Cracks - Bulge NONE Button (Thrown)(Started) NONE	- m Artifalle
Through Opening 15" X Q O"	DALLIOTTO DATA
	BALLISTIC DATA 5- 6- 7-
NOTE: -123- Desired Oscillograph Chronograp	6 1 4 2 1 6 martin and 1 1 4 annual martin at 1 2 annual 1 2 annua
All limits are for this	for this thickness to nominal gauge, gaugo, based on gauge, established this impact only. from column 6 and
plate and this obliquity	(Adjusted from previous impacts.
MEAN	- Column 47
Striking velocity (f.s.)	
REMARKS BLOCK has The REINE	ORLING ROUS SPACED AT 6"
CENTERLINES The land	
more went through	the Controle block

Limit that Control Acceptance or Rejection recommended F(e/d, ⊕)_

N.P.G. Photo. No. NP9-51402 Gun 14/50 MK11-0 No119-1-2

Rife No -
Butt Firing IMPACT No. 39416
IMPACT D'ATTE /0/30/5
U. S. Naval Proving Ground BUTT No. BUTT NO.
Dahlgren, Va. 194
OBJECT BALLISTIC TEST OF. 1000 Lb. G.P. LOW DAAG BON
MK EX10-12 (DAVID-18) =
Propagation M.D.C. LEGERARD (1) A. A. A. M. A.
PLATE PROJECTICE
- 1 d
Gauge 24" Caliber 14"
Class CowenETE BLOCK Maker N.T.Co.
Maker N.P. G. Type GP Low DRAG No. Group Lot No. Year of Specification
Contract Mark Ex 10 Mod. 12 No. D&G - 18 Date received Date received
Dimensions /44"×/44" × 24" Capped or uncapped
No. of impact on plate Weight (capped)
Thickness at impact 24" Weight (uncapped) 94776
OBLIQUITY
Impact dimensions 35" x 39" Fuze
PENETRATION COMPLETE Filler VERMICHLITE
Flaking front 56"1x 60" Flight by screen
Flaking back 5/" X 59" Condition after firing:-
Dist. from top, bottom 74" : EFFECTIVE or INEFFECTIVE
Dist. from right, left 72" INTACT
Dist. from nearest impact O
Dish NONE No Detormation
Spur NONE
Cracks - Bulge NONE
Button (Thrown)(Started)
Through Opening 19"X 21"
BALLISTIC DATA
NOTE: -1- 2- 3- 4- 4567- Destroit Oscillorranh Chromograph Limit, estimated Actual, adjusted Limit, for nominal Limit
All limits are for this bested on gauge, establish
plate and this obliquity of impact only. (Adjusted from column of previous impact only.)
country.
Striking velocity (f.s.) 1000 Suff
REMARKS BOMB MINDS FOR FOUND FILE CONCRETE BLOCK
ItAD WE BEENFORTING FORE AT 6' SENERS . Paris.
DE TO IMPACT
Limit shots only Accentrace or Rejection recommended
e/d., SECURITY INFORMATION
$F(e/d, \Theta)$
N.P.G. Photo. No. 1079 - 51403
TARLEXE

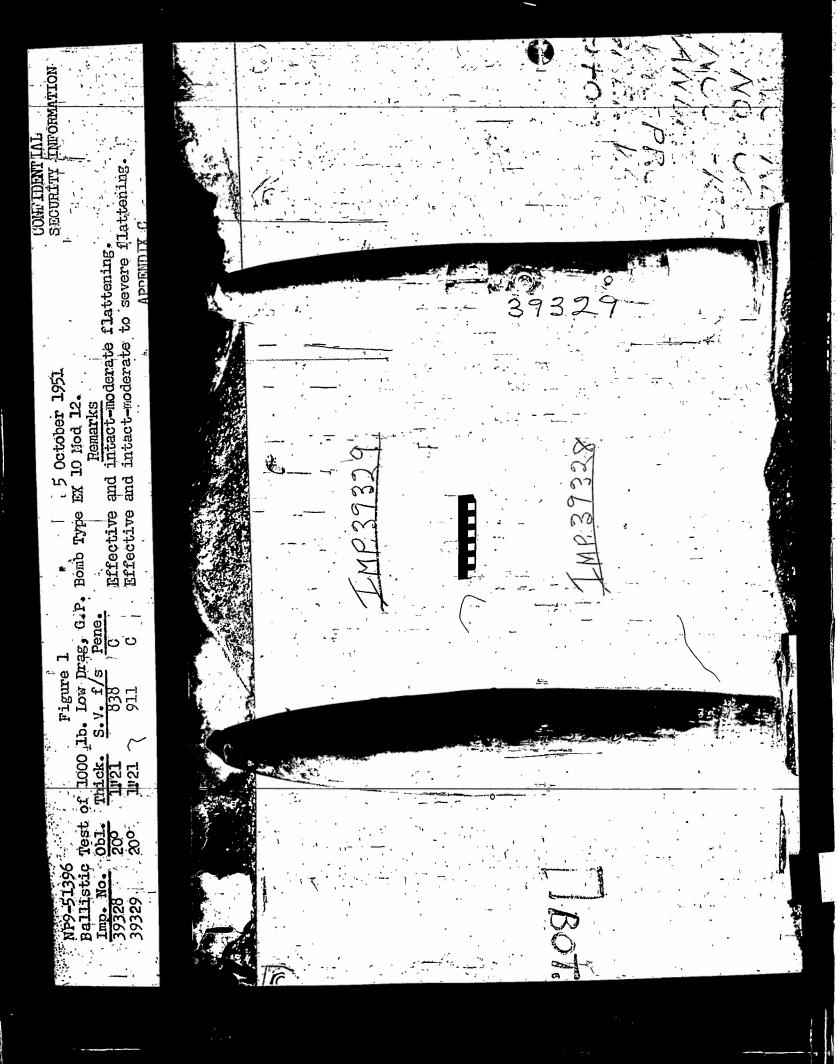
LCDR. U.S. Navy

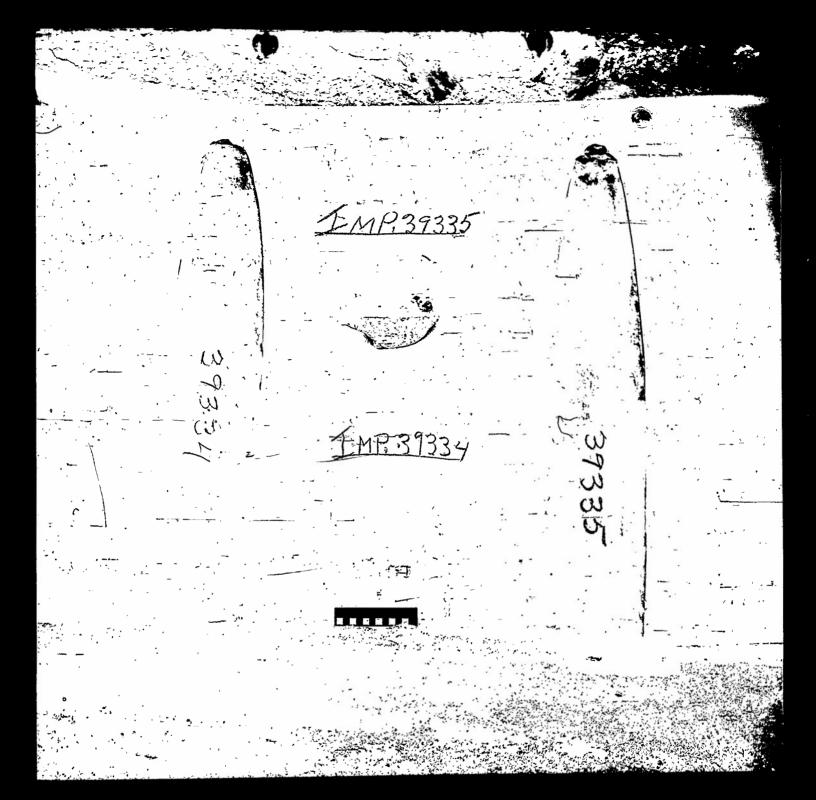
		١.
File	No.	1.32
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Butt Firing
U.S. Naval Proving Ground

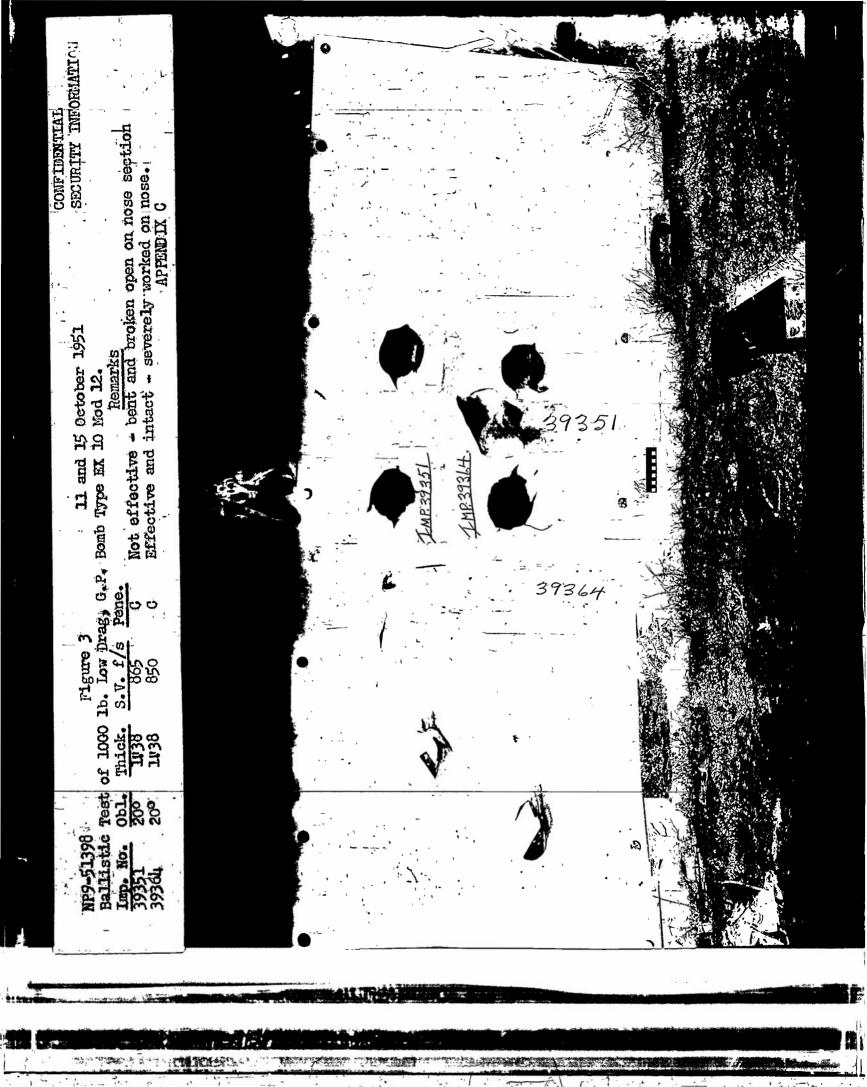
IMPACT No. 39438
IMPACT DATE //= 5 5
BUTT No.

	Dahla	gren, Va	11-5-51	1 9 4	*	1999 and second Al accompless and an		
OBJECT_PAILIS	TIC. TE	5T 07	1000 1	B. E.B	Low	DRHG		
FORIA FX 10-	/2.		.			*.		
Reference N.P.G. L	ETTER 6	www. Brancol	720.	DA DA	TED			
PLA	ГЕ	¥	Born & G.	P. LOW DRIPS	ROJECTILE			
Gauge Constitut TAGE	677 30°		Caliber					
Class Control		•	Maker	N.T. Co.	•			
Class Control Maker A Pro-		• 1	Type 6	B. Low	DERE			
No Grou	ρ		Lot No	Year	of Specificat	tion		
Contract			Mark Ex.	172 Mod	/2 No	D+120		
Date received			Date received					
Dimensions			-Capped-or uncapped					
No. of impact on plate			Weight (cap)			, . ·		
Thickness at impact 3	0:0		Weight (unc	apped)	931.00	·		
OBLIQUITY 30°			Length (unc	apped)	78:40			
	" x 45"		Fuze					
	RTIAL		Filler	VERMIC	21 155			
Flaking front 55 " *	\$6.	, ,,,,,,,,	Flight by screen					
Flaking back 28 Y	36" 78"		Condition after firing:-					
Dist. from top, bettem	78"		EFFECTIVE or INEFFECTIVE					
Dist. from right, left	5/2		Bomb broke auto					
Dist. from nearest impact	Co.	,		4	Maryke	— I		
Dish			and of the	Mars.	and in	-		
Spur Cracks - Bulge	2		de la l	in the second		1		
Button (Thrown)(Started)	<u> </u>	- 194				.		
	X In "					<u> </u>		
Through Opening	A	4		BALLISTI	Capara			
	- <u>2</u> -	<u>.</u> † (**)		PALEISTF 25-	-6-	7-		
NOTE: -1- Desire		-3- Chronograph	Limit, estimated	Actual, adjusted		Limit, for nominal		
All limits are for this			for this thickness of impact.	to nominal gauge.	gauge, based on this impact only.	gauge, established from column 6 and		
plate and this obliquity only.	,	, ,			(Adjusted from column 4)	previous impacts.		
	MEARY	<u> </u>		, , , , , , , , , , , , , , , , , , , 				
Striking velocity (f.s.)	886		N T		<u> </u>	. •		
REMARKS	' : ',			. 3				
			TIAI	- 				
	/2 - 3 mg/m - 1975 - 1985 1982 1982 1982 1982 1982 1982 1982 1982		THE WASTERSON THE	-		*********		
	######################################	The Figure	Time					
Limit shots only				-seeptance or	Rejection rec	ymmendeu		
e/d,	- A*			- HATTE	<u>i</u>			
F(e/d, ⊕)				A REPORT	Elicent torson	# 		
N.P.G. Photo. No. NP9-5	1404	for much the second	110	Constituted !	24 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4 4	U.S. Navy		
Line:	14 15 Ex . 1	MR 11-	0 1176	-	TARL	E XIV		





	NP9-51397		Tri carr	70 2		9 Octo	ber 1951.	COMMIDENTIAL SEJURITY INFORMATION	-
	Ballistic	Test,	.ot T000.	Tp. TX	ow Dr	ag, G.P.	Éomb Type EX	10 ilod 12	•
,	Imp. No.	Obl.	Thick.	S.V.	f/s	Pene.	Re	emarks	
١.	39334	200	11:38	98	2,2	C	Not effective	- severely bent and drawn.	
	,			•	- ~		Sides flattene	ed cracked long from nose	
							to 25" aft.	,	
	3 93 <i>3</i> 5	20°	1113B	. 35	35	C	Effective and	stact- oderate flatteni	•
				•			_	- APPENDIX C	



CONFIDENTIAL
N.P9-51399 Figure 4 11 October 1951 SECURITY INFORMATION
Ballistic Test of 1000 lb. Low Dray, G.P. Bomb Type EX 10 Mod 12.
Imp. No. Obl. Thick. S.v. f/s Pene.

Not effective - bent and broken open on nose section.

APPENDIX C

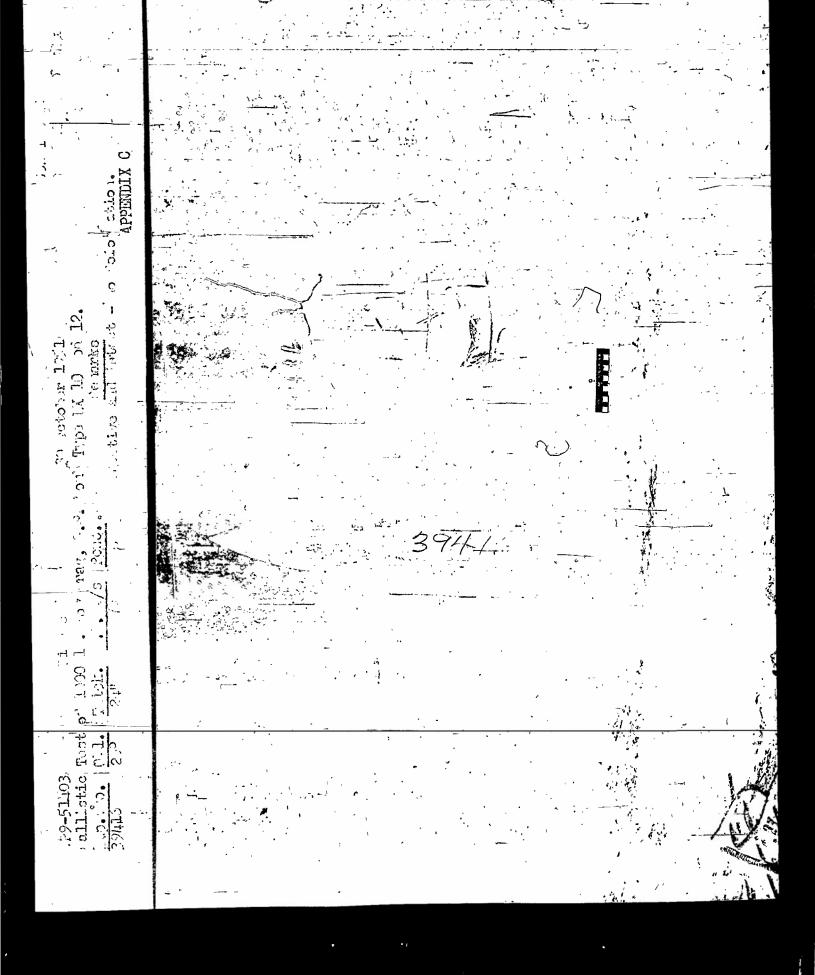
COLFT DENT TAL. Not effective - roken ore: on nose.

APPENDIX 6 | NP9-51400 | Tigure 5 | 15 0:tober 19:1 | 15 0:

Effective and Intact - vorm slightly and worked. Eallistic Test of 1000 lb. Low Drag, G.?. Boat T.pe Ex 10 od 12. Imp. No. Obl. Thick. S.V. f/s Pene. Felective and Intact. 13 October 1951 Figure 6 991 300 Imp. No. 39376 NP9-51401

SOU IDENTIAL SOUR SINCE

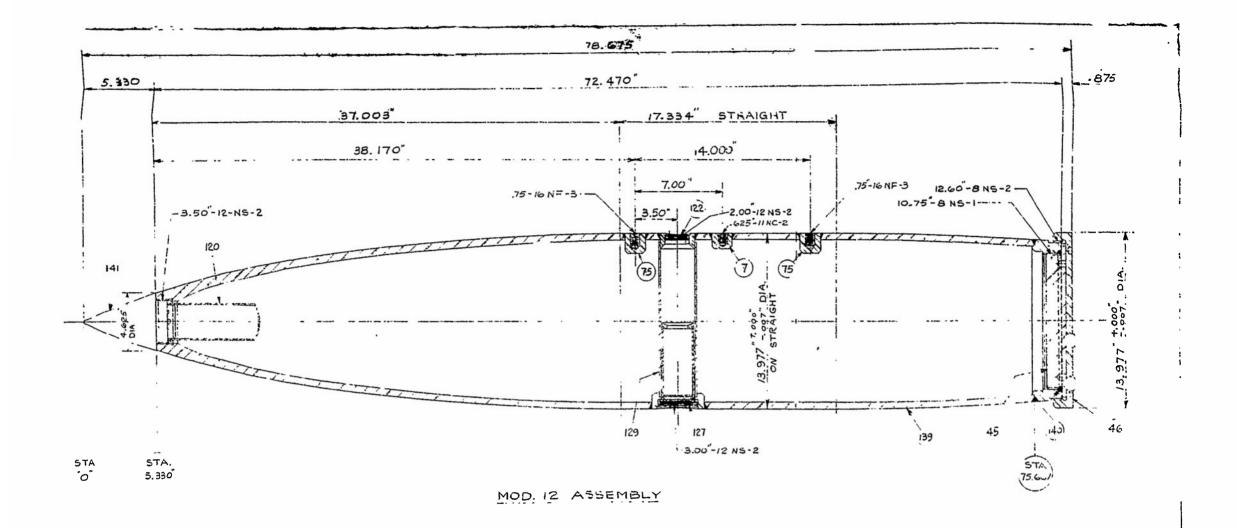
- 1932 Eirouji and off. APPLITUIX C For broke into 2 misses. Fase stusk in 10: 25 1ctolog 20 1



CONFIDENTIAL Bomb broke into 2 pieces - nose through and off. Base stuck in block. NP9-51404 Figure 9 Figure 9 Salitatic Test of 1000 lb. Low Drag, G.P. Bomb Type EX 10 Nod 12. Pene. Thick. 0b1. 150 No.

SECURITY INFORMATION

APPUNDIX C.



NOTE:-

APPLY RUST PREVENTIVE COMPOUND MIL-C-972 GRADE II TO BOURRELET ON 17.334 STRAIGHT SECTION OF BODY,
THREADED SECTION ON BASE END OF BODY
AS SHOWN IN PHOLIMINARY SKETCH NOS, 45,
46 AND 139.

ASSEMBLY OF GUN FIRE BODY PRELIMINARY SKETCH NO. 142
DR. BY J.C.S DATE 4-24-51
CH. BY 900 DATE 4-124-51
APP BY EAST DATE 4-124-51

Figure 14 APPENDIX D

T3412+1.6

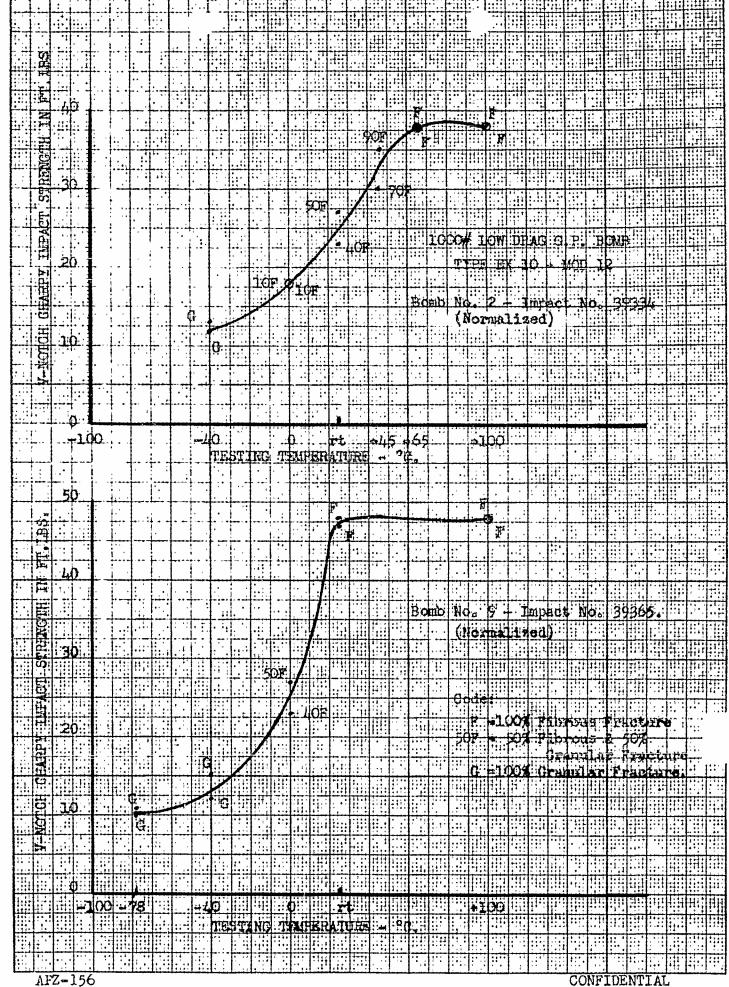


Figure 11.

SECURITY INFORMATION

MILLIVETER OF

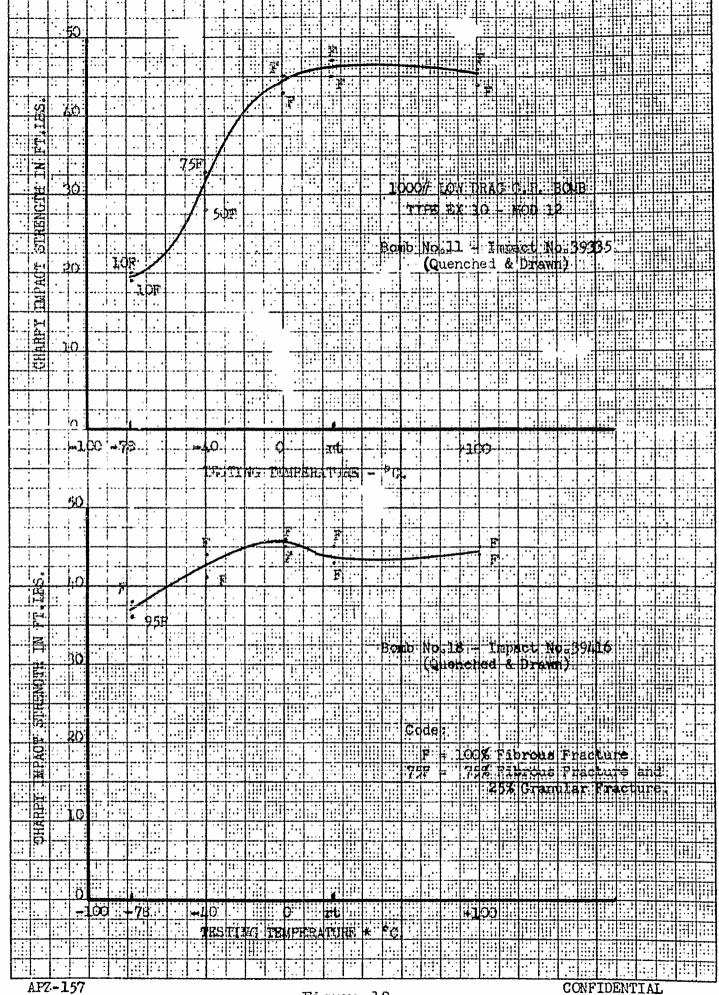


Figure 12.

SECURITY INFORMATION

Ballistic Tests of 1000# Low Drag, G.P. Bomb Type EX 10 Mod 12

TABLE XV

V-Notch Charpy Impact Tests at Various Temperatures

Testing Temp.°C		No. 2 Fracture *		No. 9 Fracture *	Charpy	No. 11 Fracture		No. 18 Fracture
- 78			10 11	G G	19 20	10F 10F	36 38	95F F
- 40	12	G	12	G	33	75F	44	F
	13	G	15	G	28	50F	41	F
0	18	10F	23	40F	45	F	45	F
	18	10F	27	50F	43	F	46	F
+25	27	50F	48	F	45	F	43	F
(rt)	23	40F	47	F	4 7	F	45	F
+45	35 30	9CF 7OF						
+65	38 38	F F						
+100	38	F	48	F	44	F	45	F
	38	T	48	F	46	F	44	F

^{*} F denotes 100% Fibrous Fracture.

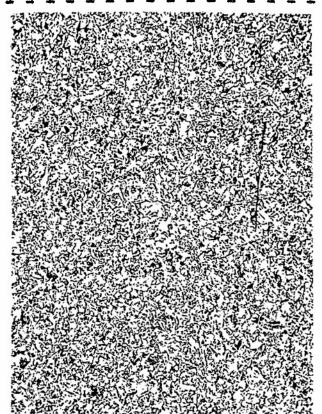
10F " 10% " and 90% Granular Fracture.

G " 100% Granular "



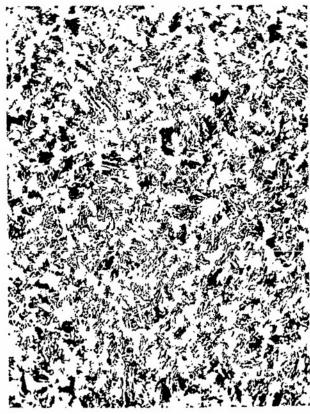
Figure 13.

APPENDIX

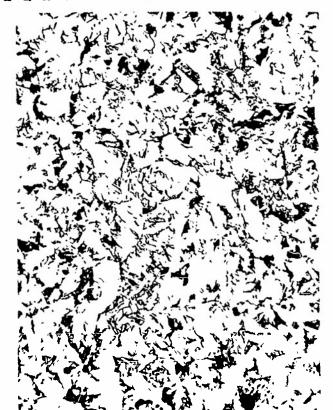


M-1957

Bomb No. 2 - Normalized Nite!-Picral Etch. Magn. 250X



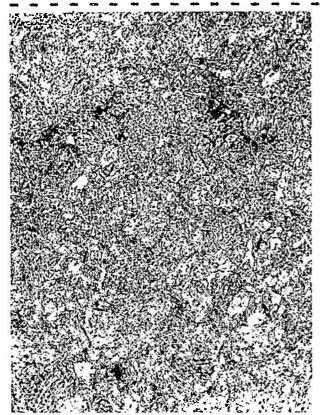
M-1955
Bomb No. 9 - Normalized Nital-Picral Etch. Magn. 250X CONFIDENTIAL SECURITY INFORMATION NP9-49148



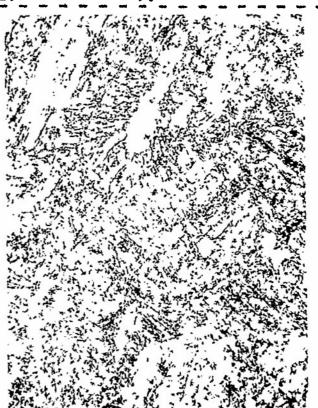
Bomb No. 2 Normalized Picral Etch. Magn. 1000X



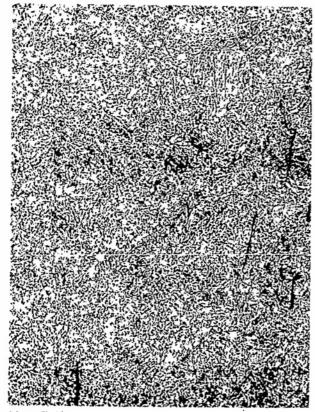
M-1954 Fig. L. Bomb No. 9 - Normalized Nital-Picral Etch. Magn. 1000X



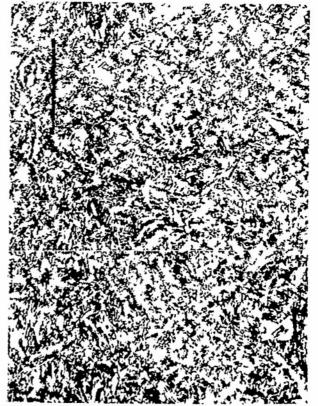
M-1953 Fig. <u>18</u>
Bomb No. 11 - Quenched & Drawn
Nital-Picral Etch. Magn. 250X



M-1952 Fig. 19
Bomb No. 11 - Quenched & Drawn
Nital-Picral Etch. Magn. 1000X



M-1951 Fig. 20
Bomb No. 18 - Quenched & Drawn
Nital-Picral Etch. Magn. 250X



M-1950 Fig. 21
Bomb No. 18 - Quenched & Drawn
Nital-Picral Etch. Magn. 1000X

CONFIDENTIAL SECURITY INFORMATION

NP9-49149

APPENDIX F

Ballistic Tests of 1000# Low Drag, G.P. Bomb Type EX 10 Mod 12

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Ballistic Tests of 1000% Low Drag, G.P. Bomb Type EX 10 Mod 12

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